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A few evidences about the current growth of French cities

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Since the end of the sixties, the trend of economic globalization has resulted in a progressive and appreciable change of national economies which has led to a noticeable restriction of State's rooms of manoeuvre. The current stage of world "regionalization" (as shown by the growing importance of the European Community, NAFTA, etc...) is one of the main illustrations of this increasing, centuries old, and irrepressible trend. Thus the problem of the relevance of a welfare State, of any public intervention at a regional or urban level seems to be implicit in this frequently stated evolution.

Public intervention has never been neutral for the dynamics of French territories. Nevertheless, how could the fact that henceforward decisions are mostly taken at a global level be taken into account ? Facing the globalization of firms' productive and spatial strategies, how could local actors'concerns really influence the future of their territories ? Can we contend that an irreversible stage of a "counter-keynesian revolution" has been reached, as to local public policies ?

The main idea which will be developed in this paper will try to challenge this commonly assumed impairment of the power of local public policies in the field of urban dynamics. Thus, the creation of strategic urban plans will be stressed as a major promoting and stimulating action in order to enhance the level of the economic growth of cities. This assertion lies on the preliminary statement of the fresh outbreak of uncertainties which has been entailed by the globalization of economies. Thus, this paper will intend to show to which extent the existence of strategic urban plans may succeed in solving the uncertainties which could otherwise shackle urban growth and dynamism.

The first section describes the data and presents the variables, the assumed effects of which will be tested. Section II deals with several regression diagnostics which will be checked in our ordinary least squares (OLS) regressions. Section III questions the relevance of the assumptions and presents the results for the growth of French cities.

1 : Explanatory variables and initial assumptions for the model

First, the data and the choice of the dependent variable will be detailed (A). Then the assumed links between this dependent variable, standing for urban growth, and our set of explanatory variables will be emphasized (B).

A) How to measure the GDP of French cities

The data concern the 214 most important French metropolitan areas, considering the level of employment, from 1982 to 1996. Several problems have to be faced in order to estimate their economic growth. As a matter of fact, the added values and GDP which are calculated at a local level are known to be unreliable, and even sometimes unavailable for confidentiality reasons (when cities are specialized in strategic productions). Wealthes which are locally generated are hardly measurable, because of the lack of regional and local significant data.

The amount of population is easily available, but it is not a sufficiently discriminating variable as to urban growth. In fact, an increase of population is not directly linked, in short terms, to growth and often results in an increasing level of unemployment. This reality is clearly illustrated by the biggest cities in the world, which merely belong to developing countries.

The variation of the amount of employment is neither a suitable variable, for the impact of capital has markedly superseded the one of labour concerning the determination of the GDP at a national level. Indeed, from 1982 to 1991, the GDP has been raised by 26% whereas employment has been increased by only 3,3%. Thus value added and GDP have a more and more capitalistic origin. Consequently, it could be misleading to choose job variations as a reliable proxy for urban economic growth.

That is the reason why the recourse to the bases of the local tax paid by professional people (the French “bases brutes de Taxe Professionnelle”, TP) has been considered, since it appears to be a very good proxy of the marketable share of value added (R2 = 0,99%), with a two-years lag (Guengant 1995). Thus, the French fiscal document 1389M displays these bases and their four main origins : 8% of the marketable value of lands, 16% of capitalistic assets, 18% of wages and 10% of incomes.

B) Explanatory variables

a) The relevance of the use of productive functions

Having recourse to productive functions allows to go beyond the shortcomings which are commonly characterizing sector-analyses. For instance, in the French nomenclature of jobs, computer scientists and engineers (naturally belonging to the tertiary sector) who work in industrial firms are included in the secondary sector. As a matter of fact, each job of a firm is counted in the sector to which the firm belongs. Using productive functions implies that computer engineers working for IBM or General Motors will be included in the same statistical class. Therefore, the banality of the studies which conclude to the positive effect of tertiary jobs and the negative impact of secondary jobs for growth can be notably avoided. It becomes possible to try to define the real foundations of local growth with more precise functional descriptions.

The nomenclature to which this paper refers is the result of the reprocessing of the nomenclatures of jobs and products. The specific positive impact of several functions on urban growth will be tested: R&D (DFPAR), teaching and education (DFRHF), marketing (DFPAC), finance (DPCIFI), transports (DFPCL), economic services (DPCISE), industrial production (DPBMIN), and management (DFPAG).

b) Municipal budgetary and fiscal data

The budgets of French cities and a set of data about fiscal variables for these cities have also been refered to. As to such data, the following crucial point has to be underlined. *It seems that an important part of the influence which is conveyed by budgetary variables would depend on a kind of "keynesian" basic assumption according to which municipal budgets would enhance urban economic growth thanks to the strategic plans (and investments) they could finance* (Munnell 1992, Igalens and Sire 1995).

Nevertheless, the fact that the existence of such an induced effect may not be universal does not question the validity of the spirit of this cyclically stabilizing effect. As a matter of fact, the economy of the city, whatever its structural ability to benefit from such budgetary induced effects may be, will all the more turn these effects into good account that their financial amount will be important, everything else been equal. Thus the following variables (named with their code in figures in the nomenclature of the French Direction Générale des Collectivités Locales) can be emphasized.

1) negative impact of municipal debts, for an increasing part of the local budget has to be devoted to refund previous loans, which makes inroads into the budget for investments. As underlined by Sallez and Vérot (1993 p 156), "indebted cities put investors to flight. Their projects are kept in check and they may restrict their services while weighing down local taxes". The variables which may be integrated in the model are the amount (per inhabitant -HAB- or in million francs -MF-) of the interest charges (INT), of debts (D1), the percentage of interests in functioning expenses (04) and finally the percentage of debts in functioning resources (D4).

2) positive impact of investments and cash flows : symetrically, one assumes that the more rigourous the financial management of a city, the more it is likely to generate its own cash flows in order to invest more easily (as expressed in the strategic urban plans). The variables are the amount (HAB & MF) of cash flows (AUTO), of global investment expenses (32). An index which has been created as a ratio of municipal investments per inhabitant and local debts per inhabitant (RATIO) will also be advocated.

3) inertia : growth would merely concern the cities which have already grown during the previous terms. The inertia of the growth pattern will be tested with a rank variable (RANG) of each city within the French system of cities. This rank will be calculated in relation to the amount of the bases of the TP. The biggest city will get the first rank, etc... Consequently, a negative link is supposed to appear in the regressions.

4) negative impact of the proxies of financial vulnerability : the fact that the resources of a city strongly depend on State grants and subsidies would exert a negative influence on the level of economic growth because of the uncertainties which would be generated by the potential questionning of the amount (or even the very existence) of such subsidies. Thus the importance to dispose of sufficient own financial resources is once more stressed out, in order not to depend on financial thirds. Therefore, the uncertainty which is conveyed by the important share of the only unstable TP in fiscal resources will notably be tested. Variables are the percentage of the subsidies in functioning resources (10), the percentage of the resources which are collected with the TP in the global amount of fiscal resources (22). Finally, the index of raising of the “fiscal local potential” will be used (EN27). High values express the vulnerability of the city, since previous taxes are close to their “maximum level”, which is rather dangerous if the city has to face unforeseeable new expenses.

5) securing impact of the proxies of financial stability : as the amount of local taxes (excepted TP) is really more lasting than somewhat fleeting State subsidies, the share of such local taxes in the functioning expenses is expected to convey a positive incentive as to urban growth, for symetrical reasons.

6) positive impact of urban governance : according to the assumptions made by Ricordel (1997), the influence of urban governance will be approximated by the share of local staff wages in functioning expenses (03). Because of the increased productivity which would be the result of the externalization of some municipal tasks, a negative sign of the coefficient for this index is expected to be found. In other words, the more a city benefits from this increased productivity of private sectors (which induces a lower amount of its local-staff wages), the more it is embedded in a context of participating local management and urban governance, the more it will be likely to grow.

7) key-influence of strategic urban plans : independently of the former assumptions which were based on the budget of the cities, three dummy variables will be integrated. They will take respectively strategic urban plans ("projets de villes, PROJEVIL), "goal charters" for the major regional cities ("chartes d'objectifs", CHARTBUT), and urban social contracts for quarters and suburbs ("contrats de villes", CTRATVIL) into account.

c) Recomputation of data and determination of complementary indexes

New computations of the basic data which were previously considered have led to generate further assertions.

8) impact of the specialization of the productive structure of cities : the formerly contended conclusions of the literature concerning this special point highly depend on geographical areas, on the size of the sample, etc... Even if diversification has been presented, several times, as a major factor which was favourable to urban growth (like, for instance, in Glaeser & alii 1992), this paper will put forward the existence of the opposite link. Thus, externalities and synergies between productive functions, whose existence is made easier within cities which gather similar or close activities, would justify the importance of urban functional specialization. The SPECIAL index, which is defined as the sum of squares of each functional specialization index, will be used. This global index goes higher as specialization gets reinforced.

9) importance of proximity and accessibility : it seems opportune to try to quantify the impact that proximity may exert on urban economic growth. First of all, taking the structure of the distribution of jobs in productive functions for granted, a "distance" index has been computed thanks to the "proximities" procedure of the SPSS software. This index expresses a distance between the productive structure of each city and the one of Paris

(KMPARI). Thus, standing for what can be called geographical as well as organizational proximities, it is expected to enhance urban growth, for proximities make interactions easier. Accordingly, the sign of this coefficient is supposed to be negative (as KMPARI expresses a distance). Moreover, an index of the accessibility of each city to the jobs which belong to the "corporate management" function has been computed (AXEGES). According to Huriot and Perreur (1994), this indicator can be defined as follows :

$$Aix = \sum_{j=1.....n} Xj \,.\, (Dij)^{-1}$$

Xj : value of the economic function X in the city j

Aix : accessibility of the function X in the city i

Dij : distance between cities i & j.

10) productivity of labour, wages and over-costs which are induced by the "insurancial" location in big cities. The productivity of labour has been approximated by the ratio between the bases of TP and employment. A higher productivity of labour is supposed to stimulate urban growth. Furthermore, the statistical availability of the four origins of these bases of TP (land, wages, incomes, capital) makes the computation of proxies for the productive capital and the average wage in a given city possible (CAPITA & SALAVG). Both indicators may positively influence urban growth. On the one hand, the more important capital is, the bigger the city is, the higher its probability to grow (due to inertia) will be. On the other hand, high levels of wages may embody extra-costs which must be paid in order to be located in big cities and to benefit from the kind of "insurance" (job search....) they generate. Section II will consider the diagnostics that must be checked in order to test the relevance of the results of the OLS regressions, which will be detailed in the last section.

2 : Regression diagnostics

The current considerable methodological progress in the analysis of data, thanks to a broad spreading of software tools, does not solve any kind of problems, in spite of its usefullness. As a matter of fact, the possibility to generate results and outputs quite easily entails the multiplication of careless recourses to these tools, and accordingly the genesis of unreliable results. One must keep in mind the existence of required assumptions, the violation of which would challenge the reliability of the computed results. From this point of view, a rigourous analysis of the statistical conditions which must be respected will be undertaken. Different kinds of regression diagnostics will be emphasized, as to the following points : errors of the model (normal distribution, independence, homoscedasticity) (A), multicollinearity (B), spatial autocorrelation (C), outliers (D)

A) Homoscedastic and normal residuals

Diagnostics about OLS residuals are really important because the reliability of several major statistical tests (notably Student, Fisher, ...) depends on the assumptions of normal and homoscedastic errors. Such assumptions can be checked by resorting to various means : average and standard-error values of residuals, PP plots and finally tests of the constancy of variance. This latter element will be considered thanks to the test which is advocated in Cook & Weisberg (1994) and which is based on V (y / X) = $\sigma 2$ exp ($\gamma \beta$' X), the null hypothesis being HO : $\gamma = 0$. Thus this test requires first to compute the square values of OLS residuals, and then to regress these values on the estimated values of the model (y^). This statistic, which is distributed as a Khi Square variate with one degree of freedom, can be expressed as follows :

"regression sum of squares" of e2 on y^ / 2 (Σ e2 / N) 2

B) Multicollinearity

The lack of multicollinearity is mandatory for OLS coefficients to be interpreted. Different complementary tools can detect and assess multicollinearity troubles, like the correlation matrix of the explanatory variables. Nevertheless, this commonly employed procedure is somewhat imperfect, since the absence of high correlations cannot be viewed as evidence of no multicollinearity problems. As a matter of fact, the correlation matrix is unable to diagnose situations which involve more than two variables. Thus, the following diagnostic tools will be respectively considered : cov-matrix of OLS coefficients, tolerance index and a singular-value decomposition of the variance of coefficients.

As underlined before, the correlation matrix is incapable of identifying the variables which are involved in multicollinearity issues, even if it can reveal the existence of these issues. The tolerance index conveys such an information. The tolerance of the Xk variable is the proportion of Xk's variance not shared with the other X variables.

Tol = 1 - R2k

and R2k is defined as the coefficient of determination obtained by regressing Xk on all other X variables in the model. Accordingly, the higher the tolerance, the greater the absence of multicollinearity (for R2k is low). Broadly speaking, 60% is considered as a suitable threshold in order to assess the absence of multicollinearity troubles.

When multicollinearity has to be faced, a singular-value decomposition may reveal which variables are linked one to another. The way to process such a decomposition has been formerly stressed and detailed by Belsey, Kuh and Welsch (1980). Let us remind that any n*p matrix X can be decomposed as :

X = U D V'
where U'U = V'V = Ip

and D is diagonal with nonnegative diagonal elements μk, k = 1.....p, which are called "singular values". Thus, it appears that if the X matrix possesses p-r exact linear regressions among its columns, there will be p-r zero singular values in D. More generally, a low singular value reveals the existence of a relatively strong linear dependence. Then, let us define respectively the “condition number” of a X matrix and the “condition index” of the Xk variables as follows :

$$\kappa\,(X) = \mu max \;/\; \mu min \qquad\qquad \eta k = \mu max \,/\, \mu k\,, \quad k = 1.....p$$

Thus, an “ill conditionned” matrix will be characterized by a high condition index (due to the existence of a low eigen-value, that is to say a strong linear dependence). The higher the condition indexes, the stronger the linear dependences between the columns of the X matrix. Considering empirical studies of the authors, weak dependencies seem to be associated with condition indexes around 5 or 10, whereas strong relations are associated with indexes greater than 30. Nevertheless, this is not a sufficient condition. As a matter of fact, multicollinearity can be assessed when a low singular value μj (condition index > 30) is associated with a large proportion of the variance of two or more coefficients (> 50%). Collinear variables can therefore be identified.

C) Spatial autocorrelation

Highlighting the necessity to check the lack of spatial correlation, as well as multicollinearity, constitutes a key issue. Indeed, “spatial effects, spatial autocorrelation and spatial heterogeneity have typically been ignored in statistics and econometrics. This is the case even though it has now been amply demonstrated that such effects invalidate the results of many standard techniques and require adjustment to others” (Anselin 1992 p 307). “Space does indeed matter” (ibid. p 308). “The first step in analyzing a spatial data series should be to assess the sources, nature and degree of prevailing spatial effects. If the magnitudes of these effects appear to be negligible, then output from standard commercial packages should offer reasonable first approximations. If these effects are severe, however, then the researcher must undertake a more sophisticated modeling strategy” (Anselin & Griffith 1988 p 29).

In order to discover symptoms of spatial autocorrelation, a contiguity or spatial weights matrix, often denoted by W, is required. As underlined by Getis (1990), weights matrix are frequently restricted to simple contiguity matrixes which are constructed with 0 and 1 values. This is notably the case in Anselin (1988). According to Florax and Rey (1995), one can point out that an "underspecified" W matrix (as the one filled with 1 and 0) appears to be less detrimental than an "overspecified" W matrix.

In other words, the statistical quality of the information conveyed by the computations which depend on the W matrix would be improved by using a matrix which is less extensive than the "real" one. Thus it would be better to omit the neighbourhood of a statistical observation (a city in our case) with another one, rather than to include too easily an individual in the neighbourhood of another individual. That is the reason why a "dichotomous" W matrix will be used in the third part of the paper. It will be built according to the criterion of the belonging to the same Region.

The inadequacy of OLS estimations in models with spatial dependence is wellknown. Thus, when the existence of a spatial autoregressive term can be stressed, the "spatial error" case can be described by the following model (Anselin & Hudak 1992) :

$$y = X\beta + \varepsilon$$

where $\varepsilon = \lambda W\varepsilon + \mu$

λ is the spatial autoregressive coefficient and μ is an uncorrelated error term. The null hypothesis will be the absence of spatial autocorrelation ($\lambda = 0$). Different kinds of tests can be advocated, notably the Lagrange Multiplier test. The statistic is :

$$LMerr = (e'.W.\, e \;/\; \sigma 2) \;/\; (Tr\,(W'W + W2))$$

where $\sigma 2 = (e'e \;/\; N)$

and it is distributed as a Khi Square variate with one degree of freedom. Diagnostic values for each model which will be examinated in the third section refer to this test. Nevertheless, in each case, the value of the Moran's I has also been computed, which led to the same conclusions and results.

D) Outliers

Finally, detecting outliers matters in order to assess the general dimension (robustness) or the weakness of the results (which may strongly depend on the fact that some individuals are included in the sample). Thus, a case is influential if its deletion substantially changes the regression results. Nevertheless, "influence" is sometimes hard to detect. As a matter of fact, an individual may influence coefficients yet not appear as an outlier in scatterplots. Conversely, not all outliers are influential. Influence results from a particular combination of values on all variables in the regression, not necessarily from unusual values on one or two of these variables. Thus various indexes may be used to determine how large the influence of an outlier is. Cook distance, leverage and DFBETA will respectively be considered.

The cook distance gives an insight into the ability of an outlier to influence the results of the regression. It increases as influence goes stronger. The threshold level of 0,8 can be considered as a good rule of thumb. The statistic is :

$$Di = (\beta(i) - \beta)' (X'X) (\beta(i) - \beta) / (p+1) s2$$

From the same point of view, the leverage index of the ith individual is defined as the ith diagonal element of the hat matrix H = X (X'X)-1 X'. Values greater than 2p/n will reveal influential cases . Finally, DFBETAik measures the influence of the ith case on the kth regression coefficient.

$$DFBETA_{ik} = (\beta_k - \beta_{k(i)}) / (s(i) / RSS_k^{0,5})$$

where β_k is the regression coefficient of the X_k variable

$\beta_{k(i)}$ is the same coefficient, with the ith case being deleted

RSS_k is the residual sum of squares from regressing X_k on all the other X variables (not deleting case number i).

A size-adjusted cutoff is often used. VABS ($DFBETA_{ik}$) > $2.n^{0,5}$ should detect roughly the top 5% of influential cases. These four kinds of diagnostics (OLS errors, multicollinearity, spatial autocorrelation and outliers) have been considered in each of the estimated models which have been built. These models result from a stepwise selection of variables, each variable being statistically significant (Student, 5% level)

3 : Models : the key-factors accounting for the French current economic urban growth

Several OLS regressions have been computed in order to test the relevance of the previously defined variables in the current periods (1990-96 & 1982-96). The results of such regressions will be stressed and questionned in this last part. First of all, the prevailing importance of the rank of the city must be emphasized. This statement merely reveals the underlying and insidious influence of the spatial structure of the National System of Cities. Thus, it is quite amazing thay the only rank of the city could represent about 85% of the global variability of our growth aggregate. Accordingly, without any diagnostic, and even if it seems rather simplistic, one can reasonably and significantly state that 85% of the variability of the level of urban GDP is explained by a negative link with the initial rank of a given city. The bigger the production of the city is, the weaker the rank is, the higher the production will be.

The whole set of output data which have been computed thanks to SPSS software, while determining our regressions, is detailed in annex 1. Those outputs stress the lack of any colinearity between independent variables, as shown by the high level of tolerance indexes. Moreover, the situation in which the condition index is higher than 30 and is associated with more than 50% of the variance for two or more coefficients never had to be dealt with.

For each period, a lot of regressions have been computed. A first insight into diagnostic criteria about heteroscedasticity and spatial autocorrelation has resulted in cancelling models which were suffering from one of those problems (and even both of them). Tables 1 & 2 present the main two models in which every diagnostic has been successfully checked (n°1 for 1990-96 and n°2 for 1982-96). As to model number 2, PP plots as well as high levels of tolerance indexes perfectly suit the statistical prerequisites. Nevertheless, it is advisable to notice the significant influence of an outlier in this model, which is the town of Cernay (n° 167 in the sample of data). This statistical influence is conveyed by the value of both the Cook distance and DFBETA (for the RATIO variable) which are respectively 2,86 and -0,15. These values (which will be taken into account later) don't prevent us from stressing the main following results :

- prevailing importance of the initian rank of cities (RANG84)
- positive impact of the amount of cash flows (AUTOMF94, RATIO90)
- positive influence of the global variation, from 1982 to 1996, of the average wage (D3SALAVG) and of the productivity of labour (PDUCTL96)
- importance of the existence of strategic plans (CHARTBUT)
- importance of the accessibility to power-resources (positive sign of AXEGES82, negative sign of KMPARI82)
- importance (which is often empirically omitted) of the function of industrial production (DPBMIN)

In most cases, outliers must be deleted in order to improve the reliability of the model. As a matter of fact, deleting the observation n°167 in regression n°2 leads to a better estimation of beta coefficients. However, the change of the value of these coefficients is rather marginal, except for RATIO90, the coefficient of which has beeen multiplied three times. Indeed, this latter evolution logically depends on the strong DFBETA in relation to this variable for the city of Cernay.

Nevertheless, cancelling data n°167 gives a greater importance to the regressor RATIO90, which entails a lower level of significance for SPECIAL, standing for the level of productive specialization (versus diversification). But the signs, the beta coefficients and the t-students are broadly the same from regression n°2 to regression n°2 without outliers. Consequently, it seems that the positive effect of productive specialization can be considered as merely reliable and economically significant. Finally, in the first regression (1990-96), the negative impact of the EN27 variable (standing for the former use of fiscal local potential) can also be emphasized, which confirms the assumption of a negative link between growth and budgetary local vulnerability.

Conclusion

The initial aim of the paper was to explain to which extent municipal voluntarism could be a key point in order to enhance the level of economic growth of cities (assuming that local policy would lower uncertainties, notably thanks to appropriate budgetary management). To conclude, we can safely say that most of the assumptions about the influence of our regressors seem to be confirmed. However, our set of data, which allowed to succeed in testing our assumptions, strongly depends on the main center-cities. This content of our sample does not embody an empirical choice, but is rather and only due to statistical availability. Thus, further interesting studies could concern the generalization of this analysis to the understanding of the key incentives of the growth of both peripheric cities and mostly metropolitan areas as a whole.

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models / variables	1	2	2 without point n° 167
AUTOMF94	1,83375e-6	1,6225e-6	1,55694e-6
PDUCTL96	3,20608e-6	4,14686e-6	3,31857e-6
DPBMIN		0,003177	0,003403
RANG84		-0,011809	
EN2794	-0,001436		
KMPARI82		-0,004227	-0,00401
CHARTBUT		0,36624	0,369399
PROJEVIL	0,089618		
AXEGES82		4,547633e-4	4,273180e-4
SPECIAL		0,001388	
KMPARI90	-0,003075		
RANG96	-0,01182		-0,011828
RATIO90		0,075521	0,254505
D3SALAVG		0,003826	0,004047

criteria / models	ajusted R^2	Information Aikake	PC Amemiya	SBC	constancy of variancy Cook & Weisberg	spatial auto-correlation
1	96,29	- 724,01	0,04	- 700,44	1,2	9,01
2	94,87	- 648,36	0,05	- 611,33	2,21.10e-2	8,97
2 modified	94,9	- 646,89	0,05	- 613,28	2,21.10e-2	9,94

Régression

Récapitulatif du modèle

Modèle	R	R-deux	R-deux ajusté	Erreur standard de l'estimation
1	,924[a]	,854	,853	,3565
2	,972[b]	,944	,944	,2203
3	,975[c]	,950	,949	,2091
4	,978[d]	,956	,955	,1979
5	,979[e]	,958	,957	,1918
6	,980[f]	,960	,959	,1893
7	,980[g]	,961	,960	,1869
8	,981[h]	,962	,960	,1851
9	,981[i]	,963	,961	,1833

a. Valeurs prédites : (constantes), RANG84

b. Valeurs prédites : (constantes), RANG84, AUTOMF94

c. Valeurs prédites : (constantes), RANG84, AUTOMF94, CHARTBUT

d. Valeurs prédites : (constantes), RANG84, AUTOMF94, CHARTBUT, PDUCTL96

e. Valeurs prédites : (constantes), RANG84, AUTOMF94, CHARTBUT, PDUCTL96, D2SALAVG

f. Valeurs prédites : (constantes), RANG84, AUTOMF94, CHARTBUT, PDUCTL96, D2SALAVG, VAROT90

g. Valeurs prédites : (constantes), RANG84, AUTOMF94, CHARTBUT, PDUCTL96, D2SALAVG, VAROT90, DPBMIN

h. Valeurs prédites : (constantes), RANG84, AUTOMF94, CHARTBUT, PDUCTL96, D2SALAVG, VAROT90, DPBMIN, AXEGES82

i. Valeurs prédites : (constantes), RANG84, AUTOMF94, CHARTBUT, PDUCTL96, D2SALAVG, VAROT90, DPBMIN, AXEGES82, KMPARI82

Coefficients[a]

Modèle		Coefficients non standardisés		Coefficients standardisés	t	Signification	Statistiques de colinéarité	
		B	Erreur standard	Bêta			Tolérance	VIF
1	(constante)	21,648	,049		438,329	,000		
	RANG84	-1,39E-02	,000	-,924	-34,661	,000	1,000	1,000
2	(constante)	21,298	,036		591,274	,000		
	RANG84	-1,19E-02	,000	-,787	-43,463	,000	,828	1,208
	AUTOMF94	1,964E-06	,000	,331	18,292	,000	,828	1,208
3	(constante)	21,265	,035		610,294	,000		
	RANG84	-1,16E-02	,000	-,769	-43,811	,000	,793	1,261
	AUTOMF94	1,711E-06	,000	,288	14,943	,000	,656	1,524
	CHARTBUT	,366	,076	,092	4,843	,000	,677	1,477
4	(constante)	21,131	,043		495,634	,000		
	RANG84	-1,12E-02	,000	-,745	-43,069	,000	,731	1,367
	AUTOMF94	1,763E-06	,000	,297	16,199	,000	,650	1,538
	CHARTBUT	,406	,072	,102	5,647	,000	,668	1,496
	PDUCTL96	4,167E-06	,000	,077	4,989	,000	,917	1,091
5	(constante)	21,091	,043		494,633	,000		
	RANG84	-1,12E-02	,000	-,746	-44,469	,000	,731	1,368
	AUTOMF94	1,770E-06	,000	,298	16,767	,000	,650	1,539
	CHARTBUT	,416	,070	,105	5,958	,000	,667	1,498
	PDUCTL96	3,753E-06	,000	,069	4,592	,000	,900	1,111
	D2SALAVG	1,395E-05	,000	,054	3,737	,000	,975	1,025
6	(constante)	21,085	,042		500,186	,000		
	RANG84	-1,13E-02	,000	-,753	-44,905	,000	,713	1,402
	AUTOMF94	1,741E-06	,000	,294	16,620	,000	,642	1,557
	CHARTBUT	,412	,069	,104	5,981	,000	,667	1,499
	PDUCTL96	3,433E-06	,000	,064	4,204	,000	,878	1,139
	D2SALAVG	1,355E-05	,000	,053	3,673	,000	,974	1,027
	VAROT90	6,357E-02	,025	,037	2,533	,012	,955	1,047
7	(constante)	21,146	,048		439,148	,000		
	RANG84	-1,14E-02	,000	-,758	-45,431	,000	,702	1,425
	AUTOMF94	1,720E-06	,000	,290	16,582	,000	,638	1,567
	CHARTBUT	,425	,068	,107	6,228	,000	,663	1,507
	PDUCTL96	3,225E-06	,000	,060	3,980	,000	,869	1,151
	D2SALAVG	1,274E-05	,000	,050	3,486	,001	,966	1,035
	VAROT90	6,201E-02	,025	,036	2,502	,013	,955	1,047
	DPBMIN	2,865E-03	,001	,036	2,498	,013	,953	1,049
8	(constante)	21,088	,054		388,522	,000		
	RANG84	-1,15E-02	,000	-,760	-45,914	,000	,699	1,432
	AUTOMF94	1,716E-06	,000	,289	16,696	,000	,638	1,567
	CHARTBUT	,425	,068	,107	6,285	,000	,663	1,507
	PDUCTL96	3,052E-06	,000	,056	3,785	,000	,861	1,162
	D2SALAVG	1,437E-05	,000	,056	3,890	,000	,927	1,078
	VAROT90	6,510E-02	,025	,038	2,648	,009	,952	1,051
	DPBMIN	2,867E-03	,001	,036	2,523	,012	,953	1,049
	AXEGES82	3,247E-04	,000	,031	2,206	,029	,951	1,052
9	(constante)	21,133	,057		368,307	,000		
	RANG84	-1,13E-02	,000	-,749	-43,702	,000	,639	1,565
	AUTOMF94	1,677E-06	,000	,283	16,236	,000	,620	1,614
	CHARTBUT	,420	,067	,106	6,269	,000	,663	1,509
	PDUCTL96	3,907E-06	,000	,072	4,404	,000	,698	1,433
	D2SALAVG	1,203E-05	,000	,047	3,158	,002	,856	1,168
	VAROT90	7,140E-02	,025	,041	2,913	,004	,939	1,065
	DPBMIN	2,895E-03	,001	,036	2,573	,011	,953	1,049
	AXEGES82	3,593E-04	,000	,035	2,451	,015	,940	1,064
	KMPARI82	-3,21E-03	,001	-,038	-2,213	,028	,637	1,571

a. Variable dépendante : LNBZBTP2